11993-0
Add. info

BREED®

World Headquarters
5300 Allen K. Breed Highway
P.O. Box 33050
Lakeland, Florida 33807-3050
Telephone 863-668-6000
Fax 863-668-6007

DOT/RSPA/OHMS
EXEMPTIONS & APPROVALS
01 SEP 21 PM 12:49

139491

RSPA-97-3107-13

September 20, 2001

Associate Administrator for Hazardous Materials Safety
Research and Special Programs Administration
U.S. Department of Transportation
400 Seventh Street, SW
Washington, DC 20590-0001
ATTN: R. Ryan Posten (DHM-31)

Subject: Qualification Test Report, Part Number P009828 (HSI-BD) / Exemption DOT-E 11993

Dear Mr. Posten:

Please find enclosed qualification test report number QTR-22-1289, prepared by Arrowhead Industrial Services, Inc. The tests and data presented in this report were performed by Arrowhead for BREED Technologies, Inc., registration number M5118. The purpose of the test series was to qualify a new spec 39 cylinder design for manufacture under exemption DOT-E 11993. This new design style is designated as "HSI-BD". The part number examined – P009828, has been classified by US DOT Competent Authority Approval reference number EX-0105217.

An application for renewal of exemption DOT-E 11993 will be submitted within the next couple of weeks. The renewal application will include technical information to incorporate the HSI-BD design style.

If you have any questions or require additional information, please contact me by fax at 863-668-6228, by telephone at 863-668-6035, or by e-mail at gamlend@breedtech.com.

Sincerely,

David Gamlen
Manager, Packaging Engineering

\Packaging Engineering\E-11993\HSI-BD_QTR.doc

QUALIFICATION TEST REPORT
PART NUMBER P009828 (HSI-BD-300)
QTR-22-1289

Manufactured by:

BREED TECHNOLOGIES, INC.
5300 Old Tampa Highway
Lakeland, Florida 33807
USA

Prepared by:

ARROWHEAD INDUSTRIAL SERVICES, INC.
3537 South N.C. 119
Graham, North Carolina 27253
USA

For

UNITED STATES DEPARTMENT of TRANSPORTATION
RESEARCH and SPECIAL PROGRAMS ADMINISTRATION
APPROVALS BRANCH

Date: July 18, 2001

Prepared by:

TJ Keller
Lab Manager

Approved by:

RG Wilson
Vice President

TABLE OF CONTENTS

1.0 SCOPE

This document is to detail the tests and inspections performed on Air Bag Inflator Cylinder Part Number P009828 (HSI-BD-300) manufactured by Breed Technologies, Inc. located in Lakeland, Florida and currently manufacturing cylinders per the requirements of 49 CFR 178.65, Specification 39. This document details the tests and inspections performed by Arrowhead Industrial Services, Inc. in order to ascertain the acceptance of the units to the requirements of the design package outlined in the U.S. Department of Transportation documents.

2.0 PURPOSE

The purpose of the reported tests is to verify compliance of Part Number P009828 (HSI-BD-300) manufactured by Breed Technologies, Inc. to the requirements of exemptions testing per the U.S. Department of Transportation. Testing was performed in accordance with applicable sections of 49 CFR 178.65, DOT-E 11993, Arrowhead Industrial Services, Inc. Quality Assurance Directive 100, applicable CGA pamphlets, and applicable ASTM standards.

3.0 HYDROSTATIC BURST TESTS

Burst testing was performed on three representative samples of Part Number P009828 (HSI-BD-300). Testing was performed in accordance with the requirements outlined in 49 CFR 178.65(f)(2) and DOT-E 11993 § (7)(b)(1) the following results were recorded:

Cylinder Number	Burst Pressure	Failure Mode
040	15,400 PSIG	SIDEWALL
120	15,100 PSIG	SIDEWALL
001	15,363 PSIG	SIDEWALL

4.0 FLATTENING

Flattening tests were performed on three samples, Part Number P009828 (HSI-BD-300). The samples were identified as #44, #84, and #124. The flattening tests were performed in accordance with 49 CFR 178.65(g). The cylinders were flattened between 60 degree-included angle, wedge shaped knife-edges, rounded to a 0.5-inch radius. The cylinders were flattened to a thickness of six times the wall thickness. After flattening, the cylinders were inspected and found to be free of any defects or anomalies.

5.0 MECHANICAL PROPERTIES TEST

Mechanical properties tests were performed on one cylinder supplied by Breed Technologies, Inc. The mechanical tests were performed to determine yield strength, tensile strength and elongation percentage. Two tensile specimens were removed from the cylinder sidewall in the longitudinal direction and each at 180 degree intervals. The specimens were machined to a gauge length of at least 24 times the cylinders wall thickness with a width not over 6 times the wall thickness. The results are as follows:

Sample	Yield Strength PSI	Tensile Strength PSI	% Elongation 24t
A	110,597	117,112	13.53
B	109,748	116,194	14.46

6.0 MACRO ANALYSIS

Macro etch testing was performed on sample number M1 from Part Number P009828 (HSI-BD-300). The macro etch test was performed per ASTM E 340-95. Following etching, the sections were examined per the requirements of 49 CFR 178.65(c)(2)(vi) and were found to be acceptable. The metallurgical report can be found in Appendix "B".

7.0 CHEMICAL ANALYSIS

Chemical analysis was performed on one sample removed from the parent metal of Part Number P009828 (HSI-BD-300). The sample was identified as BD 300. A Check analysis was performed to verify that the steel conformed to the requirements of 49 CFR 178.65(b)(1)(i) and DOT-E 11993(7)(a)(2). The Chemical Analysis report can be found in Appendix "B". The results are as follows:

Element	Maximum	Actual
Carbon	0.15	0.11
Phosphorous	0.05	0.010
Sulfur	0.06	0.006

8.0 RADIOGRAPHY

Radiographic inspection was performed on one sample from Part Number P009828 (HSI-BD-300). The sample was identified as E220103. The radiograph was accomplished in accordance with ASMEVIII and CGA pamphlet C-3, section 5.10. No anomalies were noted. The Radiographic NDE Report can be found in Appendix "B".

9.0 SYSTEM DISCHARGE

Three fully functional cylinders, Part Number P009828 (HSI-BD-300) were subjected to a system discharge. The units were identified as L01, L02, and L03. The three units were discharged and no anomalies were noted.

Thirty-Five fully functional cylinders were set up in each of two as shipped packages and stacked one on top of another.
One unit in the center of the lower package was discharged. The packaging received damage due to pressure release but it was limited to the cardboard of the lower package only, the remaining sixty-nine cylinders received no damage and did not discharge.

10.0 BEND TEST

Two specimens were taken from Part Number P009828 (HSI-BD-300) for bend testing. The samples were identified as 01 and 02.The samples were taken at the circumferential weld joint. The specimens were subjected to Guided-bend testing using a standard bend test jig per CGA pamphlet C-3 § 7.7.2.3. After bend testing, the samples were visually inspected. The test results were found to be acceptable in accordance with CGA pamphlet C-3 § 7.7.3.2.

11.0 CHIMNEY FLUE TEST

Three fully functional cylinders, Part Number P009828 (HSI-BD-300), were subjected to chimney fire test per CGA pamphlet C-14, section 7. Each cylinder was tested in the vertical position with the initiator facing up. Cylinder temperature was monitored in three locations, top, middle and bottom. The equipment used for recording and monitoring temperature was Omega model RD 160 recorder and type K thermocouples. The fire source was a high-pressure propane burner generating an input rate of 250,000 BTU/hr. The results are as follows:

Test Number 1: P009828 cylinder Shop # 1

Time (seconds)	Thermocouple Top	Thermocouple Middle	Thermocouple Bottom
0	78°F	73°F	75°F
:30	828°F	674°F	432°F
:40	710°F	984°F	537°F
:40	Discharge		

Test Number 2: P009828 cylinder Shop # 2

Time (seconds)	Thermocouple Top	Thermocouple Middle	Thermocouple Bottom
0	70°F	67°F	77°F
:30	997°F	888°F	751°F
:34	1,081°F	881°F	810°F
:34	Discharge		

Test Number 3: P009828 cylinder Shop #3

Time (seconds)	Thermocouple Top	Thermocouple Middle	Thermocouple Bottom
0	69°F	68°F	70°F
:30	1,036°F	599°F	549°F
:42	1,314°F	858°F	690°F
:42	Discharge		

12.0 HYDROSTATIC TESTS

Hydrostatic tests were performed on Part Number P009828 (HSI-BD-300). Three samples were used in testing and identified as samples 01, 02, and 03. The three samples were tested using the Water Jacket Volumetric Expansion Method as outlined in CGA pamphlet C-1.

The test pressure was 7,600 PSIG. The following results were recorded from hydrostatic tests:

Sample Number	Test Pressure	Total Expansion	Permanent Expansion	Ratio of Permanent To Total Expansion
01	7,600 PSI	.50cc	.00cc	0.0 %
02	7,600 PSI	.52cc	.02cc	3.8 %
03	7,600 PSI	.50cc	.01cc	2.0 %

13.0 CONCLUSION

It should be concluded from the results of the tests conducted that the cylinders examined meet or exceed the requirements of the specification to which they were tested. The cylinders tested exhibited good strength and ductility as verified by the flattening tests, burst tests and tensile specimen.

APPENDIX "A"

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS

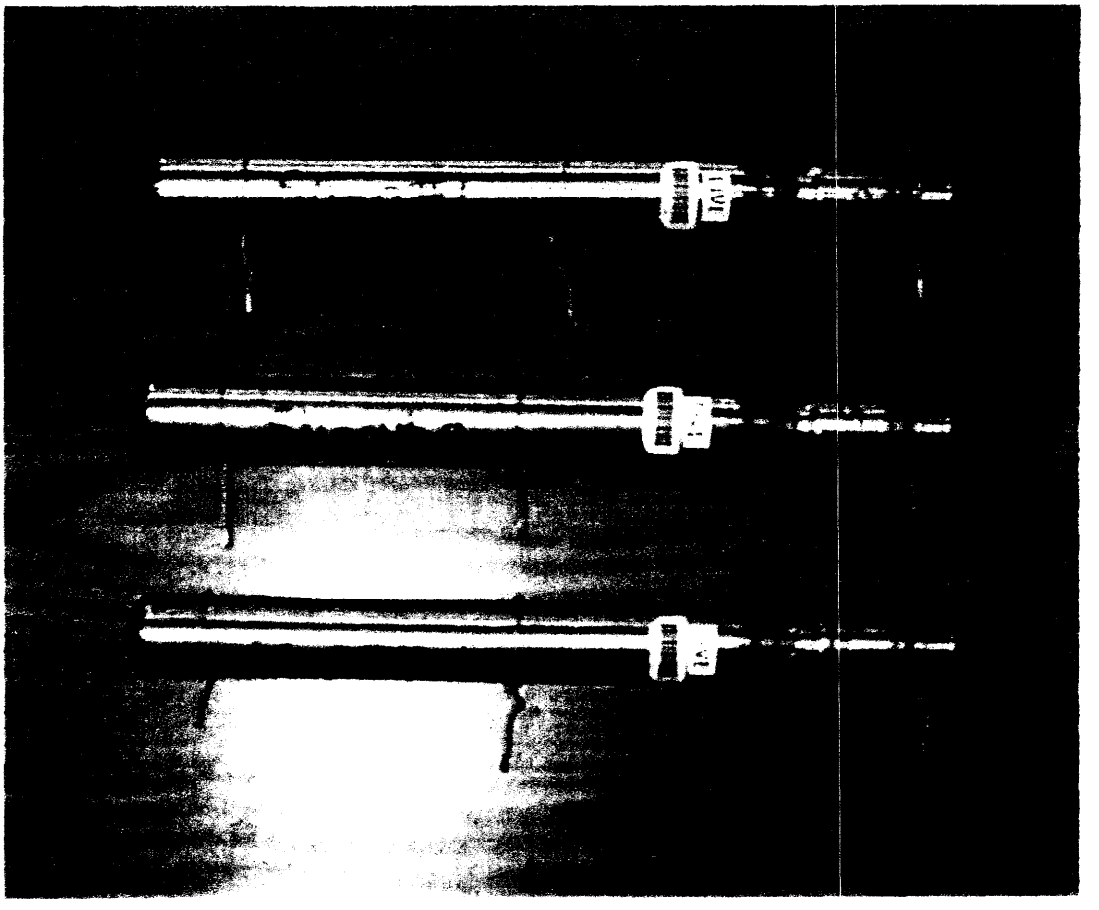
CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Pre Chimney Flu Setup Photograph

Date: 7/18/01	Inspector:

UKAS INSPECTION
045

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS



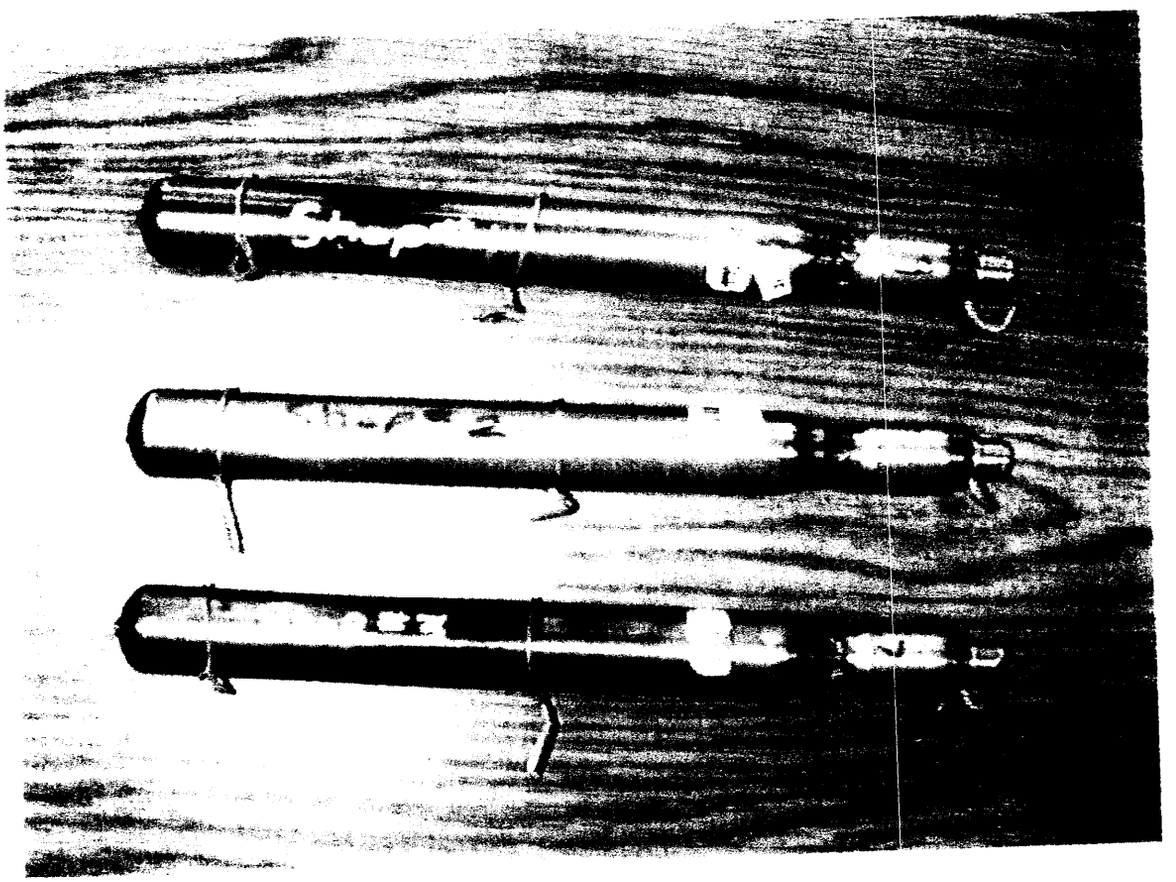
CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Pre Chimney Flu Fire Photograph

Date: 7/18/01	Inspector:

UKAS INSPECTION
045

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS



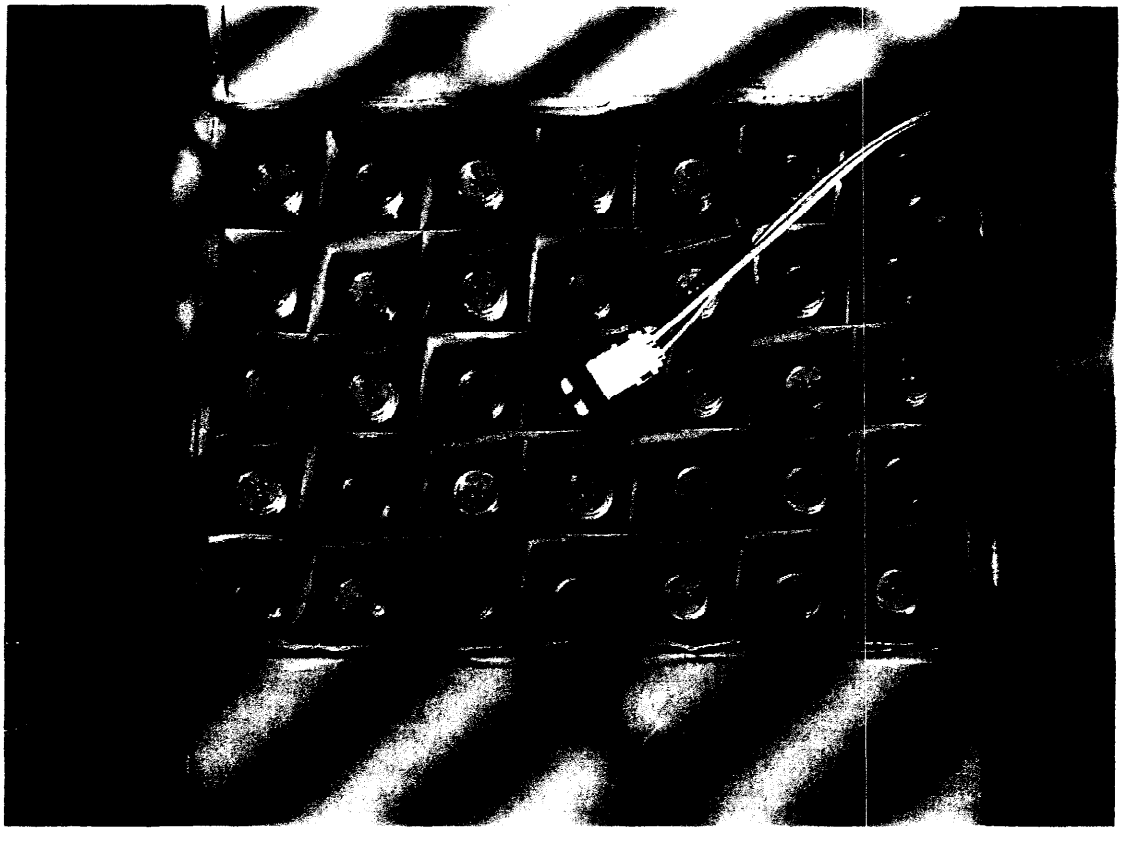
CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Post Chimney Flu Fire Photograph

Date: 7/18/01	Inspector: DJ Keller

UKAS INSPECTION
045

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS



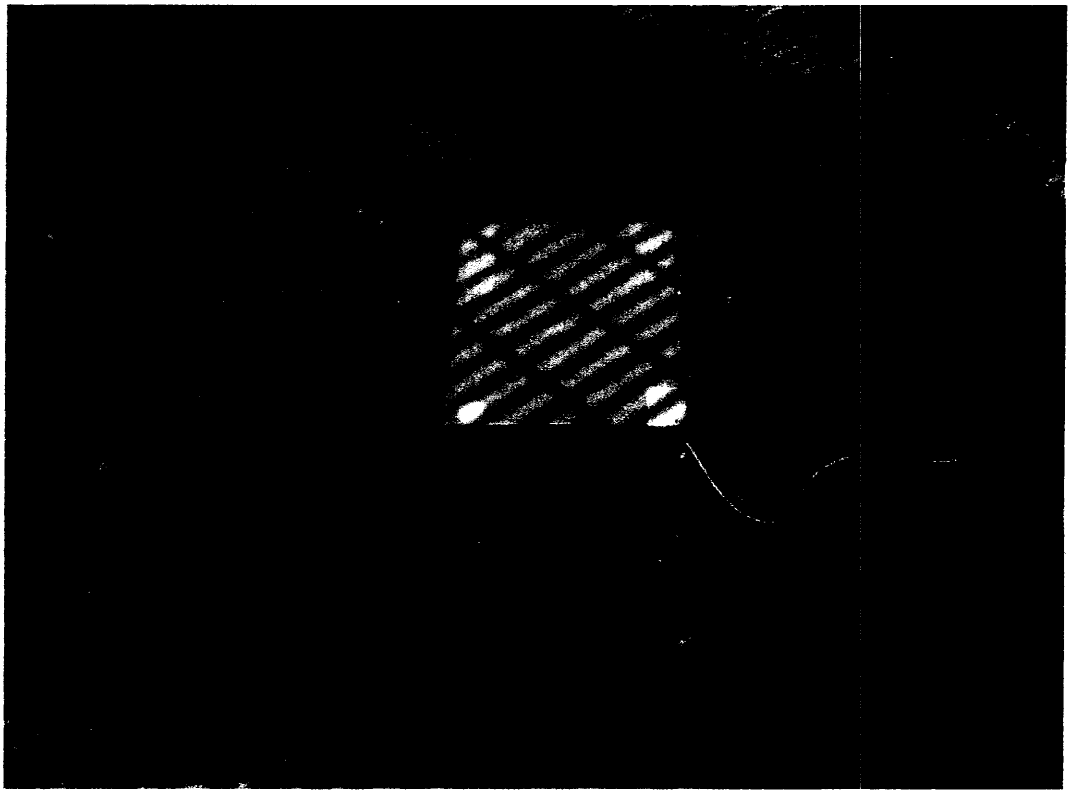
CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Pre System Discharge Photograph

Date: 7/18/01	Inspector: D Keller

UKAS INSPECTION
045

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS



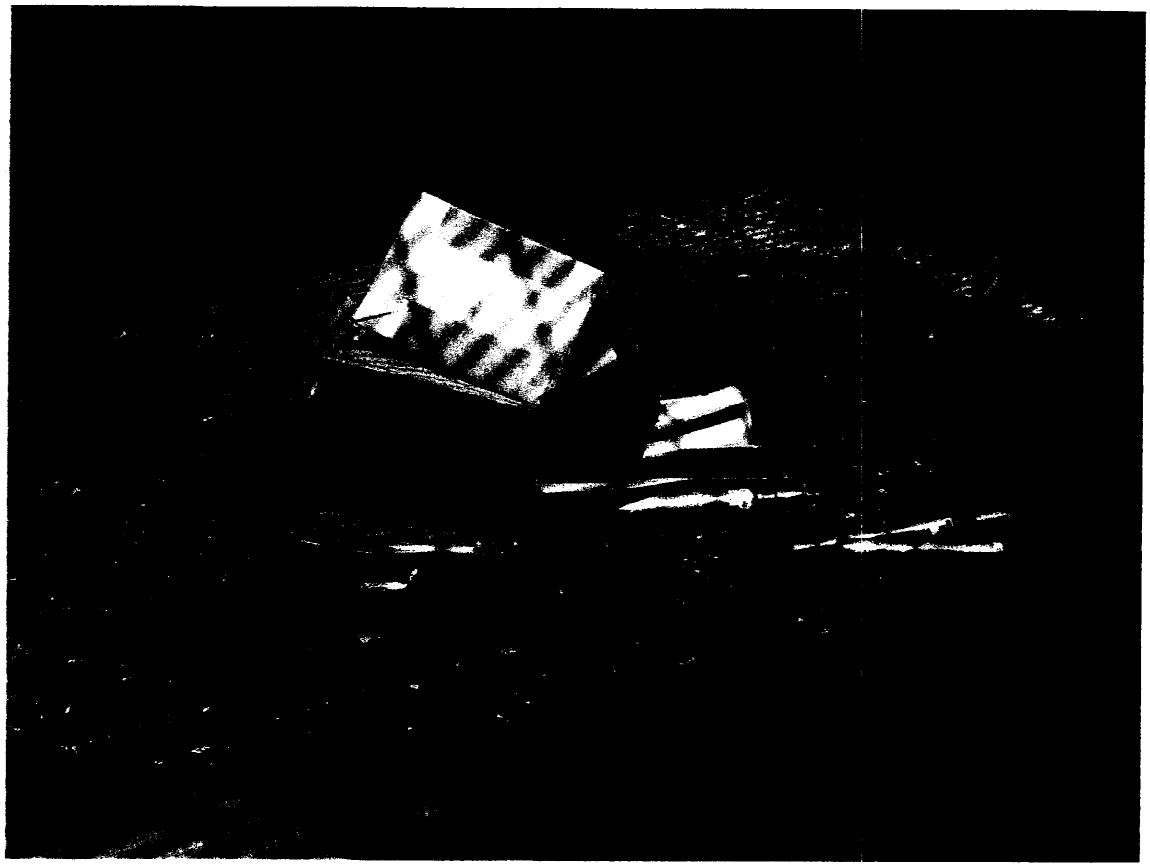
CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Pre System Discharge Photograph

Date: 7/18/01	Inspector: DJKeller

UKAS INSPECTION
045

ARROWHEAD

PHOTOGRAPHIC RECORD OF TESTS



CYLINDER CHARACTERISTICS
Part Number: HSI-BD-300 Qualification Testing
System Part Number: P009828
Post System Discharge Photograph

Date: 7/18/01	Inspector:

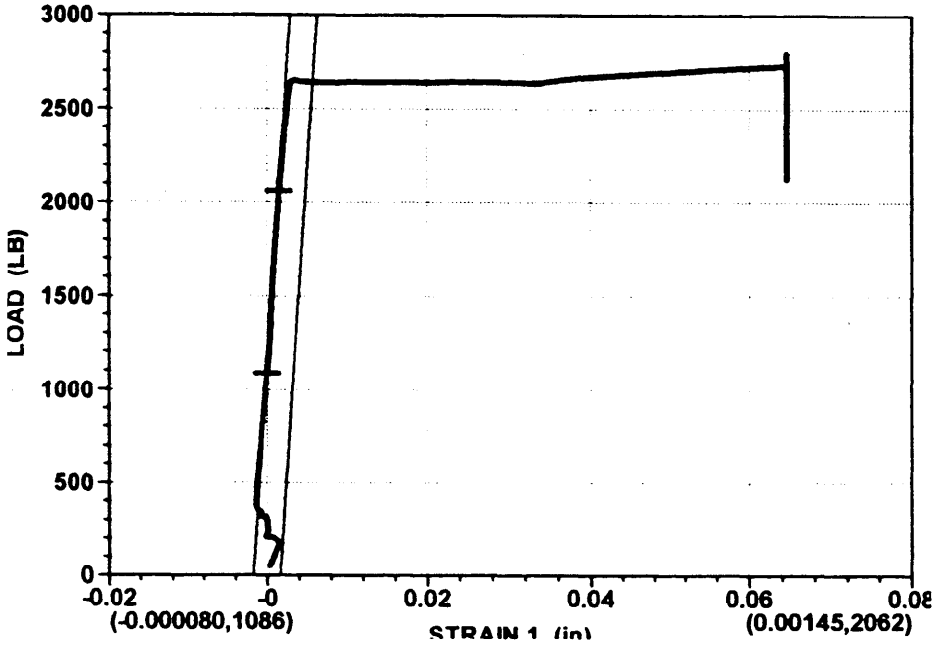
UKAS INSPECTION
045

APPENDIX "B"

Arrowhead Industrial Services, Inc.
PO Box 1000
3537 S NC 119
Graham, North Carolina 27253
USA

Specimen #:	A
JOB NUMBER:	E220103
Client::	BREED
Specification::	
Part Number:	P009827
Operator::	TJK
Geometry:	Flat
Width:	0.3370 in
Thickness:	0.0710 in
Gage Length:	1.7000 in
Area:	0.0239 sq in

Date: 07/10/01 Time: 14:33:21

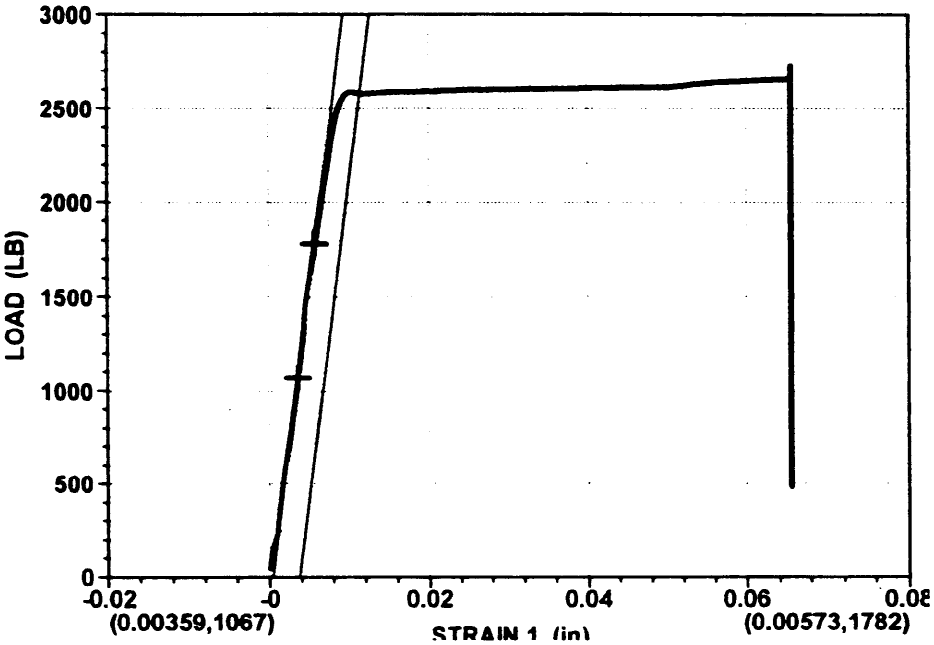


Peak Load	2802 LB
Peak Stress	117112 psi
Yield @ 0.20 % Offset	110597 psi
Elongation @ Break	13.53 %
Reduction of Area	53.73 %

Arrowhead Industrial Services, Inc.
PO Box 1000
3537 S NC 119
Graham, North Carolina 27253
USA

Specimen #:	B
JOB NUMBER:	E220103
Client::	BREED
Specification::	
Part Number:	P009827
Operator::	RPC
Geometry:	Flat
Width:	0.3360 in
Thickness:	0.0700 in
Gage Length:	1.6800 in
Area:	0.0235 sq in

Date: 07/10/01 Time: 14:47:05



Peak Load	2733 LB
Peak Stress	116194 psi
Yield @ 0.20 % Offset	109748 psi
Elongation @ Break	14.46 %
Reduction of Area	49.32 %

IMR TEST LABS
A Division of Ithaca Materials Research & Testing Incorporated

NADCAP Accredited MATERIALS TESTING LABORATORY

131 Woodsedge Drive, Lansing Business & Technology Park, Lansing, NY 14882
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July 11, 2001

TJ Keller
Arrowhead Industrial Services, Inc.
3537 S. NC 119
PO Box 1000
Graham, NC 27253

IMR Report # 20013089

CERTIFICATE OF ANALYSIS

P.O.:	455446
Date Received:	July 6, 2001
Sample ID:	BD 300
Material:	Carbon Steel
Specification:	UNS-G-15130 (AISI 1513)

SUMMARY STATEMENT

The sample **meets** the chemical requirements of UNS-G-15130 for an AISI 1513 carbon steel. Note the presence of boron in the sample.

The results are on the following page.

CHEMISTRY

Element	Sample	UNS-G-15130
C	0.11	0.10 - 0.16
Mn	1.39	1.10 - 1.40
P	0.010	0.040 Maximum
S	0.006	0.050 Maximum
Al	0.05	---
B	0.0005	---
Cr	0.12	---
Cu	0.12	---
Mo	0.07	---
Ni	0.09	---
Si	0.35	---

Results in weight percent unless otherwise indicated.

Method in accordance with ASTM E 415-99a.

Reviewed by:

Peter Damian
Chemist

Reviewed by:

Lou Koconis
Laboratory Manager

IMR TEST LABS
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Toll Free 888.464.8422

July 10, 2001

T J Keller
Arrowhead Industrial Services, Inc.
3537 S NC 119
P.O. Box 1000
Graham, NC 27253

IMR Report # 20013090

CERTIFIED MATERIAL ANALYSIS

P.O. #: 455446
Date Received: July 6, 2001
Sample: M1
Specification: 49 CFR 178.65(c)(2)(vi)

SUMMARY

A plug weld in a 3.7mm nominal wall thickness steel tube sample was submitted for examination. The plug weld had been saw cut longitudinally through its center. This section was polished, etched with 2% Nital, and examined with an optical microscope at 11.5X. Length of fusion for L1 is 1.25mm, and L2 is 1.48mm (see Figure 1).

Prepared by:

Roy Hopkins
Metallurgist / Failure Analyst

Reviewed by:

David Christie
Senior Failure Analyst / CWI

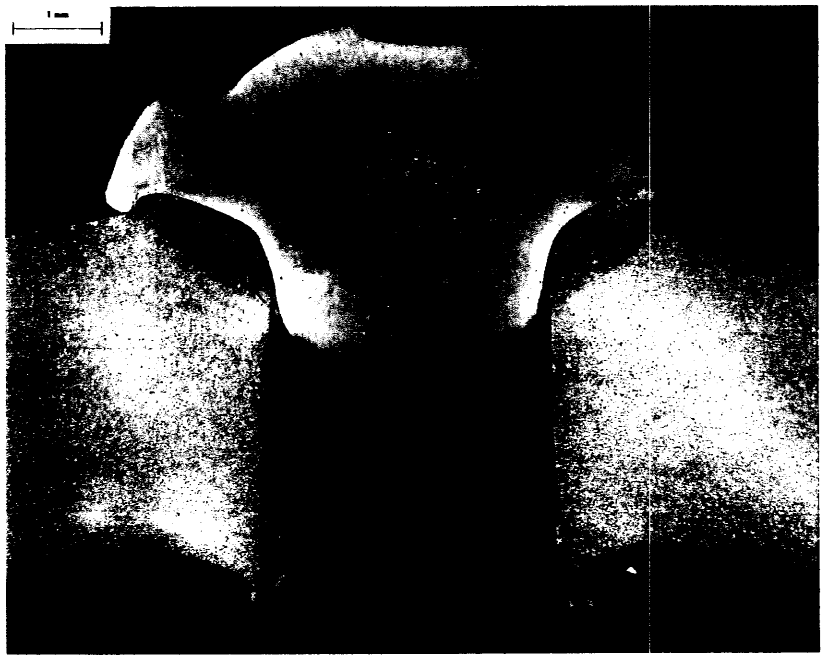


Figure 1) Cross section of plug weld, Nital etch. L1 = 1.25mm, L2 = 1.48 mm. 11.5x

TRIAD T Nondestructive Testing, Inc.
P.O. Box 2342
Kernersville, NC 27285-2342
(910) 996-2578

RADIOGRAPHIC NDE REPORT

PAGE 1 OF 1

PROJECT ARROWHEAD JOB NO. UNIT 1 ☐ 2 ☐ 3 ☐ 4 ☐ DATE 7-2-01

DRAWING	SYSTEM	LINE	WELD/ITEM NUMBER
			REFERENCE CGA-C3

DESIGN CLASS/CATEGORY

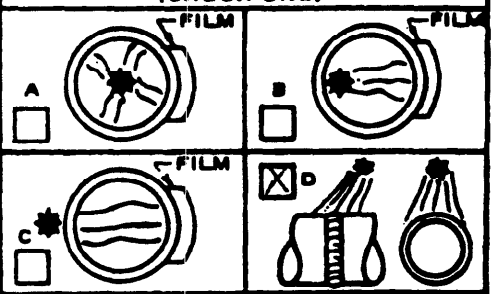
ACCEPTANCE STANDARD: ☐ ASME III ☐ VIII ☐ B31.1 ☐ AWSD1.1 ☒ OTHER

ITL. TYPE	MTL. THICKNESS	O.D./LENGTH	SURFACE FINISH	NDE PROCEDURE
CS	1/8	VARIOUS	☑ AS-WELDED ☐ GROUND ☐ OTHER	NO. REV

STAGE OF MFG. ☐ INFO ☐ REPAIR ☐ ROOT ☐ INTERMEDIATE ☒ FINAL

JOINT DESIGN ☐ N/A ☐ BRN ☐ BKS ☐ INS ☐ OPN. BT ☐ SOCKET ☒ OTHER

X-RAY	ISOTOPE	LEAD SCREENS
MAKE PICKER	IRIDIUM 192 ☐ COBALT 60 ☐	FRONT: .005 ☐ .010 ☐ CENTER: — BACK: .005 ☐ ☒ .010
KVP. 90 M.A. 5	SIZE DIA. — LENGTH —	
FOCAL SPOT SIZE	CURIES	RT STANDARD SET-UP (CHECK ONE)
FILM MFG. D7 ASTM CLASS 1 ☐ 2 ☑	LOADED 1 ☒ 2 ☐ OTHER ☐	
FFD. 18"	EXPOSURE TIME MIN. 2 SEC. —	
PENETRAMETER SIZE 10 MTL. PB ASTM ☐ ASME ☐		
PENETRAMETER SOURCE SIDE ☒ FILM SIDE ☐		
SHIM MTL. — THICK —		
RADIOGRAPHER TonyBraylock CERT. LEVEL II		
VIEWING SINGLE ☒ COMPOSITE ☐	FILM PROCESSING ☐ AUTOMATIC ☒ MANUAL TEMPERATURE 68	☐ E OTHER (ATTACH SKETCH)



LOCATION MARKERS	SENSITIVITY	WELD DENSITY	PENETRAMETER DENSITY	ACCEPT	REJECT	POROSITY	SLAG INCL.	CRACK	INCOMPLETE PENET.	INCOMPLETE FUSION	UNDERCUT	ROOT UNDERCUT	BURN-THRU	CRATER PIT/CRACK	ROOT CONVEXITY	ROOT CONCAVITY	ROOT CREASE	TUNGSTEN	UNCOM. INSERT	SURFACE DEFECTS	ARTIFACTS	REMARKS (STATE "N.A.D." IF NO APPARENT DISCONTINUITIES) CGA-C3
0	2T	✓	✓	✓																		E220102 N.A.I.
0	2T	✓	✓	✓																		E220103 N.A.D
90	2T	✓	✓	✓																		E220102 N.A.I.
90	2T	✓	✓	✓																		E220103 N.A.D

INTERPRETER [signature] CERTIFICATION LEVEL II FILM EVALUATION DATE 7/2/01

(TO BE COMPLETED AS INDICATED)

IF APPLICABLE CONTRACTOR REVIEWER	TITLE
FILM REVIEW DATE	COMMENTS
IF APPLICABLE QA REVIEW DATE / /	IF APPLICABLE A.N.I./A.I. DATE / /